Letters to the Editor

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NOTES ON HIGH VOLTAGE THYRATRON PULSER AND ON FILLING GAS FOR NEON TUBE HODOSCOPE CHAMBER

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Two inportant considerations for successful operation of neon tube hodoscope chamber recently developed by Bandyopadhyay *et al* (1966) and not reported in the said paper are pointed in this note in brief.

Thyratron Pulsers : In order to increase the time resolution of pulsed neon tube hodoscope chamber for particle selection, it is always desired to have a narrow pulse of short rise time under load and the pulse should be applied as soon as after the passage of an ionising particle through the chamber. The value of the applied pulse voltage is denoted by the value of the anode voltage of the thyratron divided by the distance between the plates of the chamber. We have used a 5C22 hydrogen filled thyratron in our experiment.

The thyratron time delay is composed of two parts, the ionisation time of the grid-cathode region and the breakdown of the grid-anode space. The larger delay is in the former and may be reduced by the application of a high input pulse. The second delay is a function of the plate voltage.

Since a large grid drive tends to decrease the delay of the thyratron, a high power EFP60 trigger circuit has been developed for our experiment as shown in Fig. 1. The tube is normally cut off and uses positive feed back from dynode to grid. The output from the dynode may give a large power mainly due to 1500V applied to the plate of the tube and to rather generous cathode emission characteristic of EFP60. Moreover, the dynode surface is very sensitive and emits a copious amount of secondary electrons, on the average about four for each incident primary electron. Other methods to reduce the delay time include the increase of heater current of the thyratron and the application of a positive bias voltage to the grid. The later is significant near the firing potential.

The simplest shape of the high voltage pulse is approximately an RC exponential decay, where C is the output capacitor and R a resistor across the chamber. For our experiment we have selected the value of 10^{-7}sec. for the time constant, i.e., C = 0.001-μF and R = 100-ohms, and the condenser is chargbed to a potential of 8KV from a conventional high voltage power supply.

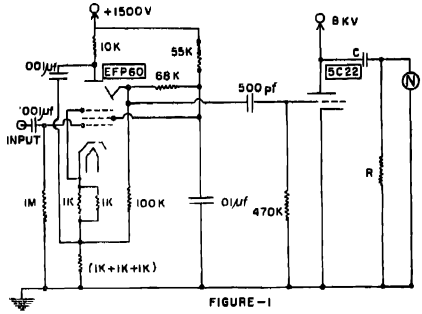

Fig. 1. High Power EFP60 Trigger Circuit.
N—indicates the position of the chamber.

Filling Gas In order to get better efficiency the tubes should be filled with the mixture in which a small amount of argon is added to the neon. The addition of argon increases the specific ionisation. One can find data about this in an article by Druyvesteyn and Penning (1940). The main idea is that if one has neon alone, then in course of the avalanche, the electrons produce ionisation which gives rise to a multiplication of the electrons, but more frequently the electrons raise neon to an excited state which then does not improve the reproduction factor of the electrons In mixture of neon with a small amount of argon the excitation energy is partly used for the ionisation according to the reaction

$$Ne^* + Ar \rightarrow Ar^+ + e^- + Ne.$$

Excited neon collides with argon and gives ionised argon plus neon, now de-excited, so one gets in this way a much higher efficiency for reproduction of electrons, and the breakdown voltage occurs at much lower values.

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Druyvesteyn, M. J. and Penning, F. M., 1940, *Revs. Modern Phys.*, **12**, 87.